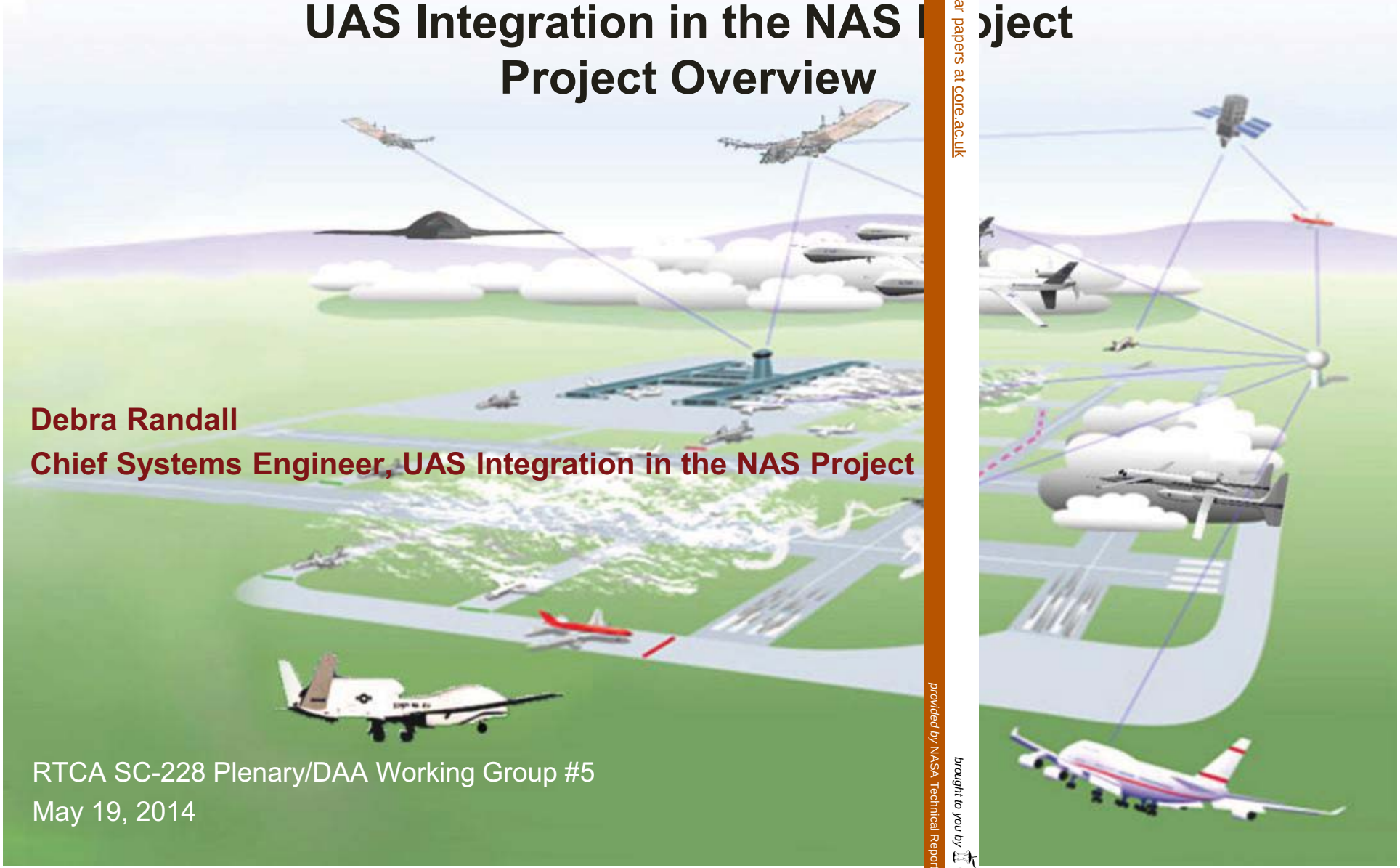
National Aeronautics and Space Administration

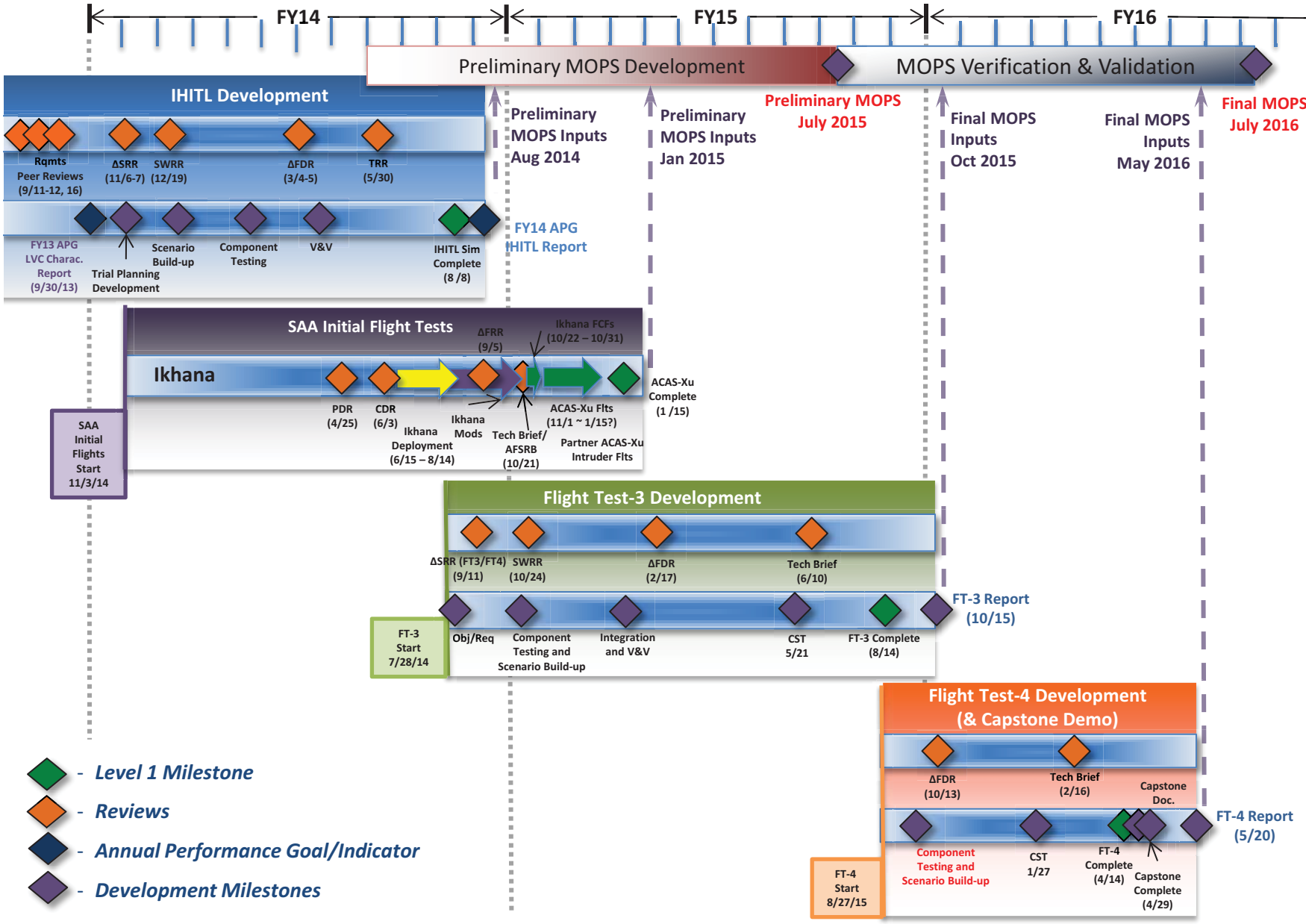
UAS Integration in the NAS Project
Project Overview



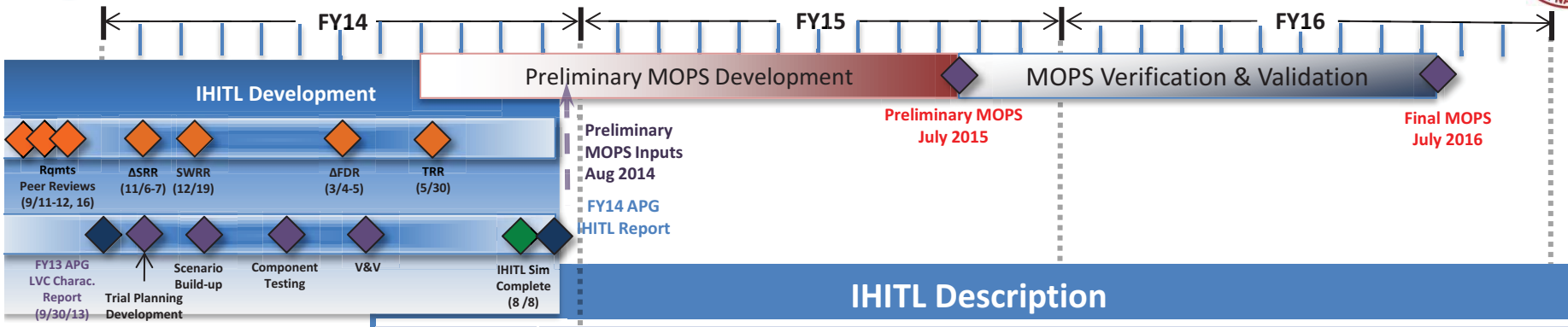
Debra Randall
Chief Systems Engineer, UAS Integration in the NAS Project

RTCA SC-228 Plenary/DAA Working Group #5
May 19, 2014

IT&E Integrated Test Flow



IT&E Integrated Test Flow
IHITL



- *Level 1 Milestone*
- *Reviews*
- *Annual Performance Goal*
- *Development Milestones*

ZFW (Dallas-Ft Worth)

ZOA (Oakland Center)

IHITL Description

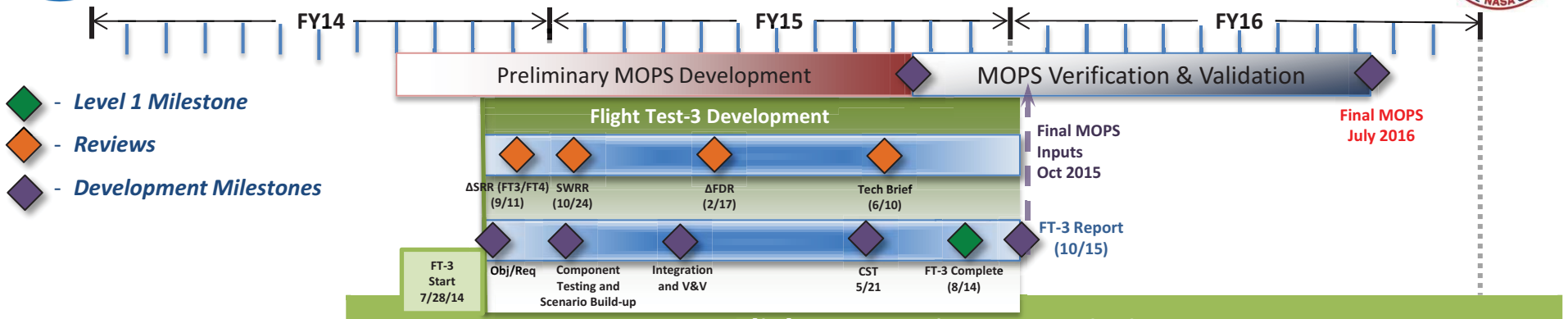
Purpose	• Evaluates and measures the acceptability of algorithms and pilot guidance displays with ATC operations with increased simulation fidelity by adding CNPC time delay, a proof of concept GCS, and VFR cooperative and non-cooperative traffic.

Approach	• 2 LVC configurations to be tested (Config1 & Config2)
	  • Config1: Ames/Armstrong connectivity (ATC and Pilot test set-ups)
	  • Config2: LaRC/Ames connectivity (SAA-CA interoperability)
	• Scenarios - Class E airspace operations near major TRACONs

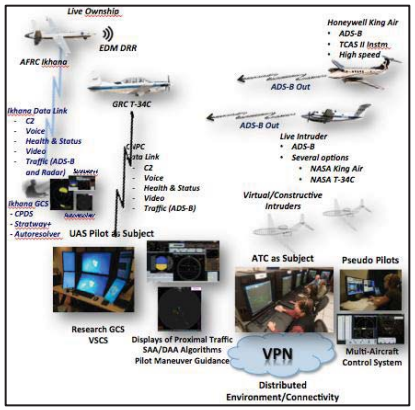
Test Duration	Jun – Jul 2014
	  • Config1 Test Set-up 1: ATC – 3 weeks (15 Controllers)
	  • Config1 Test Set-up 2: UAS pilots – 2 weeks (10 pilots)
	  • Config2 Test Set-up: ATC – 3 weeks (6 Controllers)

Tech Transfer	• Validated SAA, C2, HSI performance requirements and guidelines • Community insight into LVC Infrastructure capabilities
Project Benefit	• Validates Project models • Risk reduction for SAA Initial Tests and Flight Test Series 3 • Foundational infrastructure integrated test supports SAA Initial Flight Tests, FT3, & FT4

IT&E Integrated Test Flow
Flight Test Series 3



- *Level 1 Milestone*
- *Reviews*
- *Development Milestones*

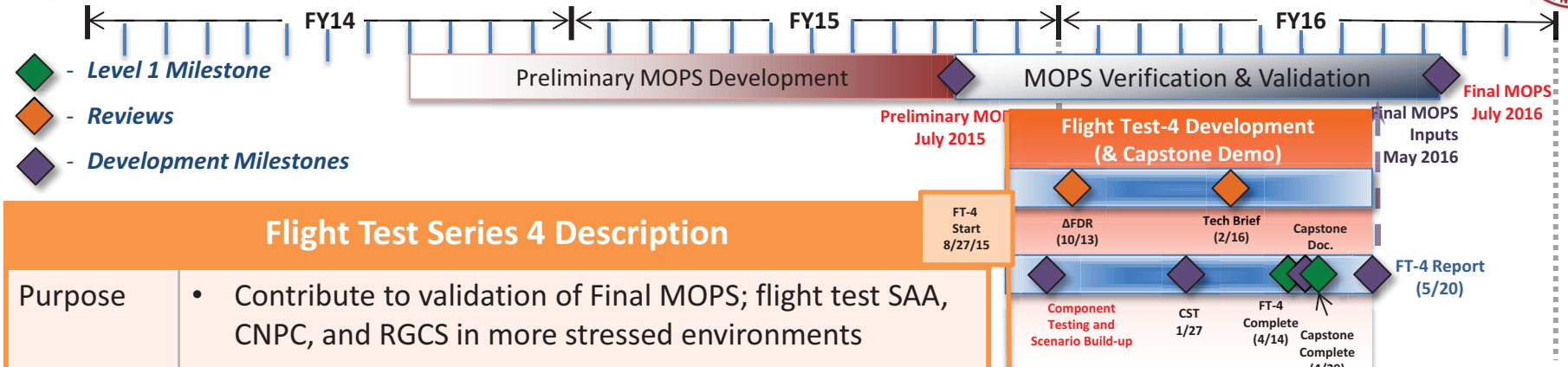


Flight Test Series 3 Infrastructure

Flight Test Series 3 Description

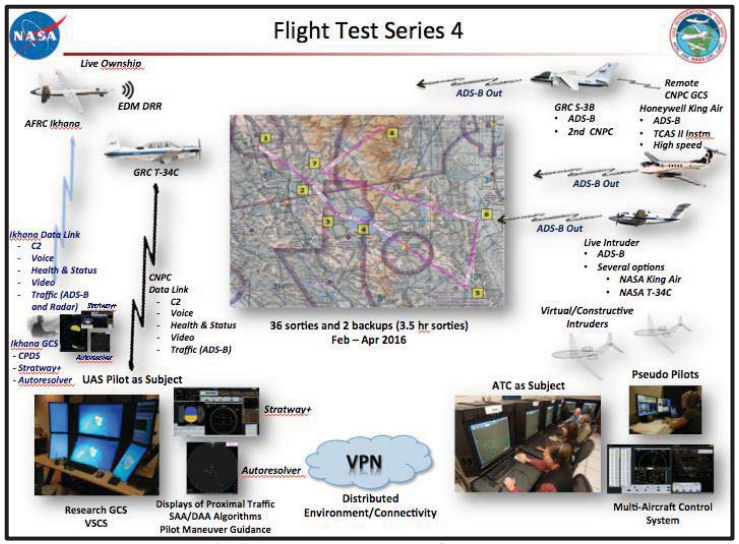
Purpose	• Flight test prototype SAA & C2 systems utilizing RGCS; conduct integrated flight test series to verify Preliminary DAA & C2 MOPS and validate sensor models • Demonstrate system integration of surrogate UAS with CNPC, RGCS, and SS Algorithms
Approach	• Increase complexity from IHITL through live aircraft incorporation and increased definition from MOPS • Focus scenarios on testing of SAA (sensitivity, pilot workload, and maneuver negotiation), C2 (CNPC Mixed Traffic Flight Tests including Integrated SAA), and human factors (RGCS utilized to evaluate pilot information requirements)
Test Duration	Jun – Aug 2015 • 36 flights/2 backups (3.5 hr flights)
Tech Transfer	• First fully integrated flight test including both prototype systems for both DAA and C2 MOPS • Initiates verifications of the preliminary MOPS
Project Benefit	• Baseline FT4 System Architectures implemented • Baseline flight test scenarios developed and validated

IT&E Integrated Test Flow
Flight Test Series 4



Flight Test Series 4 Description

Purpose	• Contribute to validation of Final MOPS; flight test SAA, CNPC, and RGCS in more stressed environments • Demonstrates systems integration and evaluation of the state of UAS concepts and supporting technologies • Demonstrate final LVC-DE configuration
Approach	Increased complexity from FT3 • Challenging encounter geometries • UAS pilot and ATC negotiation in complex/busy airspace • Two aircraft with CNPC to assess link performance within the same spectrum • Demonstrate CA/SS Interoperability, well clear compliance
Test Duration	Feb - Apr 2016 • 34 flights/2 backups (3.5 hr flights)
Tech Transfer	• DAA and C2 system refinements flight tested • Contributing to validation of final MOPS
Project Benefit	• Baseline technologies for Capstone demonstration



Flight Test Series 4 Infrastructure